Are owners and charterers really that stupid?

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1 Background

Much of IMO's thinking about regulatory alternatives for reducing CO2 emissions from ships is based on the assumption that ship owners have been slow to adopt measures which would increase fuel efficiency, even when such measures are economic, that is, should have been adopted without any regulation at all.

For example, here's how the Bahamas puts it.

> Unfortunately, due to various structural impediments in the industry, the high cost of fuel has not been the main driver for the adoption of these technical and operational measures.[1]

This failure is variously ascribed to the fact that

1. Owners know their ships will spend a part of their lives, quite possibly a large part, under term or bareboat charter. While a ship is under term or bareboat charter, it is the charterer that purchases the fuel, and decides where and how fast the ship steams. Therefore, it is claimed the owner has no or at least greatly reduced motivation to invest in fuel saving technology. The Bahamas in support correctly calls this a "key assumption" in the thinking of the IMO's Market Based Measures (MBM) working group. The MBM Working Group report repeatedly refers to "non-price barriers" which "restrict the uptake of fuel/energy operational and technical measures".
2. Owners have the ability to pass through any increase in BFO cost to their customers in the form of higher freight or TC rates, therefore there's no point investing in saving. The Bahamian submittal puts it succinctly "The high cost of fuel, although a significant factor, can be passed on through freight rates or is paid by an external party and not the owner."[2]

This view is further supported by the fact that several influential studies have found that there is tremendous potential to cut fuel consumption at little or no cost by employing technologies that owners currently are not using. For example, the Second IMO GHG Study 2009 ays CO2 emissions could be reduced 25% to 75% "by using known technology and practices."[3] DNV claims measures exist which would reduce CO2 emissions from ships by 400 MM tons per year (about 26%), which have ***negative*** abatement costs, meaning if implemented, they would increase the owner's profits.[4] DNV is forced to conclude "The results of this study indicate the lack of responsiveness to economics as a driving factor for change". This has become received wisdom at the IMO.

2 The Term Charter Issue

Let's begin with the term charter issue.[5] In any term charter, the ship owner must stipulate the ship's speed-fuel curve. The contract or charter party then goes into considerable detail about what happens if the ship fails to perform up to the warranted fuel consumption. A typical Term Charter speed-fuel clause is shown in the Appendix. Basically, the owner pays for any fuel the ship uses above the charter party curve. Prospective term charterers collect a bunch of offers each of which include not only a term charter rate but a stipulated cargo capacity, and a stipulated speed fuel curve. Then they run these offers through an analysis

[1] Need and Purpose of an MBM, GHG-WG 3/2, 2010-12-22, submitted by the Bahamas, page 1
[2] ibid, page 2
[3] Second GHG Study 2009, MEPC 59/24/Add. 1, 2009-04-09, page 10
[4] Det Norske Veritas, Pathways to Low Carbon Shipping, 2009-12-15
[5] All my comments hold a fortiori for bareboat charters so I will use "term charter" to mean any lease of the ship, whether it includes the crew or not. Most bareboats are simply financing schemes. There is nil real difference between financing a ship with a ten year mortgage, and financing the ship with a 10 year bareboat. In both cases the seller of the financial instrument is the effective owner. The owner of title in the first case; the disponent owner in the second case. In most bareboats, the disponent owner sets the specifications for the ship.

to determine which ship will meet their transport capacity at minimum cost. I operated big tankers for some 25 years and was involved in numerous TC negotiations. I can assure you that speed/fuel was front and center everytime.

Here's a memo that I wrote to my troops in July, 2002. The memo was mainly in response to their griping that our standard speed/fuel curves were unrealistic (translation: they had to work too hard to get the fuel consumption down to these levels) But it also clearly makes the point of the importance of speed/fuel curves in winning term charters. (The Empress des Mer was a ship owned by a competitor, my brother Dave.) Notice that in at least one example cited the ship with the lower term charter rate did not get the business.

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TO:  hsc_/ppd1, apb1, kis1

FROM: martingale/jack

RE: Consumption Curves in TC description, Q88, MFIX etc

The speed-fuel curves in MFIX, TC description, Q88 etc are,
ME + 1 gen + sludge under ideal conditions.  That is:

1) A fuel with an NCV of 42,707 kJ/kg.
2) Calm water, no wind.
3) Perfectly clean hull and propeller.
4) Main Engine operating right on spec.

In MFIX, we adjust this curve for actual NCV using the FO_LOSS field.
We also adjust for expected weather and current by leg using the SPD_ADJ fields.
This curve serves as an achievable target.  If we don't meet it after properly adjusting
for NCV and weather, then something is wrong and we must find out what and fix it.
We must not lower our standard.

In almost all TC's this curve will be too optimistic since it will be warranted
up to Beaufort 5.  But for TC purposes we want to over-specify the ship.
When the potential charterers run our warranted curves thru their algorithms
to get equivalent unit ($/T) transport cost, they will find
that they can pay us a higher TC rate than if we gave then a more conservative curve.
Most big Term Charterers must go with the ship that gives them the lowest equivalent unit cost.
We will get more business at a higher TC rate.
Of course, we will give some of that back in claims
but the give back is always much less than the additional TC revenue.
A classic case was the Embassy and Empress des Mer with Vela in 1990.
The Embassy using a conservative curve got $39,000 per day and paid no penalties.
The Empress using a ridiculously optimistic curve got $41,000 per day
and ended up paying $250,000 in penalties.
The additional TC revenue over the 4.5 yr charter was about 3.3 million dollars.

Later the Empress finessed the Grand out of a one year KPC charter that, in a falling market,
we desperately wanted.  The brokers told us that the Empress was in
at (from memory) 26,000 per day and firm.  So we went slightly lower and firmed.
The business went to the Empress at the higher TCE.
Later I found out from KPC that Dave had over-specified
the ship by more than a knot over calm water speed.
We had only over-specified the Grand by using calm water.
The KPC chartering guy told me that the Empresses's speed-fuel curves were "really sexy".
We too have to be really sexy.
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The memo goes on to further berate the poor recipients for not meeting our fuel consumpton targets.

The point of course is that term charterers know that for the length of the term charter they will be the effective owner of the ship ***and they want the cheapest ship for the fuel cost they expect to pay during the TC.***[6] Owner shenanigans aside they will do their damndest to get her.

[6] Another misconception that sometimes surfaces at the IMO is that a term chartered ship won't slow steam as much as a ship in the spot market, especially if the TC rate is high. It turns out that a term charterer faces exactly the same

This isn't just my experience. In a 1995 study of some 10,000 Panamax bulk carrier term charters, Wijnolst and Bartelds found a clear correlation between fuel consumption and charter rate. The sum of the fuel cost per day and the T/C rate was roughly equal for almost all the charters in the sample.[7]

3 Fuel cost is a weak driver

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DNV, the Bahamas, and much of the IMO apparat agree that fuel costs have been a disappointingly weak driver for fuel efficiency. But in my career as an owner, fuel costs have not only been a strong driver, they were ***the*** driver. We adjusted our steaming speeds almost weekly on the basis of the current spot rate and our BFO costs. When the market was in boom, we were blasting along as fast as we could. When the market was in slump, we were going as slow as we could. We instituted all sorts of procedures to monitor fuel consumption, spent all kinds of time tuning the plants, hasseling the C/E's when we were unhappy, etc, etc. and on occasion firing them.

The single biggest question we asked ourselves in specing new ships is what is the BFO price going to be? One thing we did not worry about was whether or not the ship was going to be term chartered. In fact, in all the voluminous correspondence leading up to an 8 ship, half-billion dollar program in 1999/2000, the subject never came up. For we knew any efficiency we could gain would be reflected in the TC rate.

Herein lies the fallacy in the Bahamian claim that the fact that savings in costs eventually get passed on to shippers, means that owners have little motive to economize. But this competing away of savings only happens after the great bulk of the owners have implemented the savings. At that point, any owner who has not kept up will go broke.[8] Survival is very strong motivation for most people.

In the course of my career BFO went from $50 to $250. And over that 30 year period, fuel consumption almost halved. The first ships I operated were 390,000 tonners built in the late 1970's. They had a full speed fuel consumption of around 210 tons at 16 knots.[9] The last ships I operated were 440,000 tonners which burned 121 tons at the same speed. The relative improvement at slow-steaming speeds is even higher.

The latter ships were designed in 1999/2000 to a BFO cost of a little over $100 per ton. If I were building a ship today, I'd use a design fuel cost of at least $500 and probably higher, maybe as high as $750, depending on what I thought IMO was going to do. Like every owner, I would invest in any fuel reduction measure that I thought was going to improve my bottom line at that price.

In our 1999/2000 newbuilding program, we surveyed all the possibilities. And we ended up installing "over-sized" engines and generators at the cost of close to 2 million dollars per ship, in part because it allowed us to move down the engine's SFC curve toward the minimum SFC point (about 70% of MCR).[10]

We went through all the hydrodynamic devices, pre-swirl, post-swirl, etc. I became entranced with something called a propeller boss fin. The vendors claimed it would save 2 to 3% or more. You'll see the same numbers or higher in IMO documents.[11] The device only cost $140,000 so even at $150 per ton all I had to do was save 900 tons of fuel to pay for it, less than 8 days MCR steaming for the ULCC. It seemed to me it might work, so I studied it carefully. The more I got into it the less support I found for the claims. At the end of the day, I couldn't be sure if the gadget was going to save me fuel or cost me fuel. We didn't invest in the boss fin, but it wasn't because we were stupid or lazy or we were going to pass the cost of the fuel on or the ship was going to be TCed. If the device gave us a competitive advantage, we would get the savings.

So we have a disconnect. I claim owners will jump on anything that they think will make them money. IMO and others believe the owners are "unresponsive to economics". There are two reason for this dichotomy:

The potential savings are grossly exaggerated Much of the savings that some IMO studies point to simply don't exist, or are unproven, unsafe or not economic even at today's BFO price.

Take all the propeller flow modification devices. Most of them have been around for 20 years or more. The problem is separating vendor claims from actual performance. Model tests are indicative but not

short-run optimization problem in minimizing her transport costs as a spot owner does in maximizing his profits. See The Impact of Bunker Prices on VLCC Rates for a proof. From the point of view of the charterer's speed decision, the TC hire is a sunk cost.

[7] Wijnolst, N. and Bartelds, M., Analysis of the Panamax bulk carrier charter market 1989-1994 in relation to the desing characteristics, Delft University Press, 1995.

[8] This is the core reason competitive markets are efficient. The Bahamian statement shows little understanding of how competitive markets work. The same thing can be said of much of IMO's deliberations on CO2 reduction.

[9] These ships were at least twice as efficient as the smaller 1960's built ships they replaced, which in turn were at least twice as efficient as the World War II T2. A T2 could carry about 15,000 tons of oil at 14.5 knots in calm water burning 40 tons per day. A modern VLCC can carry over 300,000 tons of oil at 14.5 knots in calm water burning less than 80 tons per day.

[10] EEDI will effectively prohibit owners from doing this.

[11] Second IMO GHG Study 2009, page 172 says 4%.

quantitively reliable for these devices both because of scale effects and the artificial conditions in the towing tank. Full scale tests are even harder. If a device does save a percent or two, it will be almost impossible to see in any but long term, carefully monitored experiments. Speed goes as power to the 1/3 or less. So a 3% saving will show up as less than a 1% increase in speed at a given power. Difficult to measure under the best of conditions. But to make matters much worse, we almost never have the best of conditions. The savings, if they exist, will be dominated by all sorts of other variables, including loading pattern, hull and propeller condition, and weather. To do the necessary experiments to really determine the savings would be a very expensive proposition; so they are simply not done. We are left with vendor claims and anecdotal evidence.

Despite this, in something of a leap of faith, owners are investing in some of the more promising devices. Some 80 ships have been built with the Kawasaki Rudder Bulb System, a post-swirl device. Others have fitted pre-swirl devices. If these gadgets really work, the word will get out, and the owners will be happy to pay for them. But if the savings were anything like what IMO studies sometimes claim, this would already be obvious.

Other technologies that are offered as evidence of owner unresponsiveness are either imprudent or unproven.[12] Contra-rotating props fall in the imprudent category at least for single screw ships. There is little doubt that a properly designed contra-rotating propeller could save at least 8% on most ship types. For a VLCC the extra initial cost will be around two million dollars, for a payback of less than a year at full power. Unfortunately, contra-rotating props require complex epicyclic gearing and inter-shaft bearings. They are inherently far less reliable than a standard VLCC shaft and propeller, and would be a maintenance nightmare. No prudent owner could spec contra-rotating props on a single screw tanker. Yet most IMO studies blithely include contra-rotating props in their lists of potential savings, usually with a number like 12 or 14%.

Clearly, unproven technologies such as air cavity are also included in most such lists, often with an unsubstantiated savings of 15%.[13]

When you take a realistic look at fuel savings measures, as owners must, the savings are far smaller than IMO thinks and more expensive. greenship.org, a group that generally takes an optimistic view of the potential for vessel emissions reductions, studied a 35,000 ton bulk carrier to which they fitted just about every device applicable, and ended up with a 7% decrease in CO2 emissions.at an additional cost of about $5,000,000 or 20% of the current newbuilding price.[14] When Green Ship repeated this exercise for an 8500 TEU containership, they came up with a savings of 11 to 14% at a cost of 10 million Euros (about 10% of current newbuild price)

The Newbuilding Lag Much of the prudent, feasible, economic savings that do exist have a 10 to 20 year lag before they are fully implemented in the fleet. For example, advanced Waste Heat Recovery is now clearly economic on a large tanker. For an investment of about 1.3 million dollars, it is possible to extract enough energy from the cooling water and stack gas to support a 1000 kW generator. For a VLCC the savings in fuel is 4 or 5 tons per day. At $500 BFO, a pay back period of less than 2 years. Owners are now flocking to install these systems on their newbuildings. In August, 2010, Wartsila counted 81 big ships including 33 VLCC's that have ordered Wartsila's version of WHR.[15]

Recently we were offered the opportunity to term charter a VLCC newbuilding. This ship will be delivered in 2011. Her specifications were essentially fixed in 2009 when bunker prices were fluctuating around $400 per ton. When an owner offers a ship for term charter, he must warrant loaded and ballast fuel consumption curves. I compared the offered loaded fuel consumption curve with that of a standard 2002 built VLCC which was speced in 2000 when bunker prices were $100 to $150 per ton. The results are shown in Figure 1.

The new ship is fitted with the latest electonically controlled main engine, advanced waste heat recovery, a fancy turbocharger system, a pre-swirl device, and the latest in propeller and hull design. This ship can slow steam down to 10 knots without difficulty.

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[12] Stangely the most exciting and impactful recent technology is almost never mentioned, and that is the switch from camshaft to electronically controlled main engines. Not only does this result in a flatter SFC curve but more importantly allows ships to operate down to 20% power continuously. Camshaft controlled engines can only operated down to about 50% power. For tankers, this means that, when the market is in deep slump, we will have the entire fleet operating at 9 knots, rather than 75% of the fleet operating at 12 knots, and the other 25% laid up.

[13] Most such lists also include "speed reduction" as a CO2 abatement measure, often with a 25% savings number. Slow-steaming is not a measure; it is a reaction. The reaction depends on the current fuel cost, spot rate and the ship's speed/fuel curve. It's happening all the time. If you want more of it, simply increase the owner's fuel cost.

[14] Schack, C, Green Ship of the Future, Asia-Pacific Maritime, Singapore, March, 1010.

[15] Antonopoulos, D, Ship Power Merchant, August, 2010.

The old ship, without modifications, could not steam much below 50% power (about 13 knots) for extended periods. Above 13 knots the new ship consumes 10 to 15 TPD less than the old at the same speed. The old ship can be modified to slow steam down to 10 knots; but at 10 knots her fuel consumption will be at least 20 TPD more than the new ship.

The new ship is full powered. Her installed power is slightly more than the old ship. EEDI had no influence on her design. In fact, a big, slow turning engine was essential to obtaining the improved fuel consumption. It allowed a more efficient prop and a lower Specific Fuel Consumption.

The owner of the new ship probably spent 3 to 4 million dollars more on fuel efficiency than the owner of the old ship. But both owners made the right choices for the bunker price environment they expected.

Now we have BFO prices of $650 per ton. We can be sure that owners of the ships currently being speced will spend still more money on fuel efficiency, although they will face sharply increasing marginal costs.

In short, the claim that owners do not respond to increases in bunker prices is simply not true. But what is true is that it will take 20 plus years before the impact of the massive post-2005 bunkers price increase is fully incorporated into all ships in the fleet. In the shorter term, all we can efficiently do is to induce additional slow steaming with a carbon tax. This will not only slow the fleet down, but it will also raise rates and induce extra newbuilding.[16]

4 Bottomline

The polite bureaucratese talks about "lack of responsiveness to economic conditions" and the like. Of course, what they are really saying is charterers and owners are too stupid to run their enterprises in an intelligent manner. I ran big tankers for 25 years. I know term charterers are not stupid; they know the difference between a fuel efficient ship and one that is not. I know owners aren't stupid. I know they try to search out every fuel saving that makes sense. As an employee, you want to be a hero to a shipowner? Save him some fuel. Next thing you know, you will be married to his daughter.

We can have a valid debate about the best way to regulate CO_2 emissions from ships. But that debate must not be based on misconceptions. The belief that owners and charterers are unresponsive to fuel cost is a misconception.

[16] EEDI will do the opposite. The non-EEDI compliant ships will have a competitive advantage over the EEDI compliant. They can make more money in booms. So owners will be induced to hang on to the old ships longer.

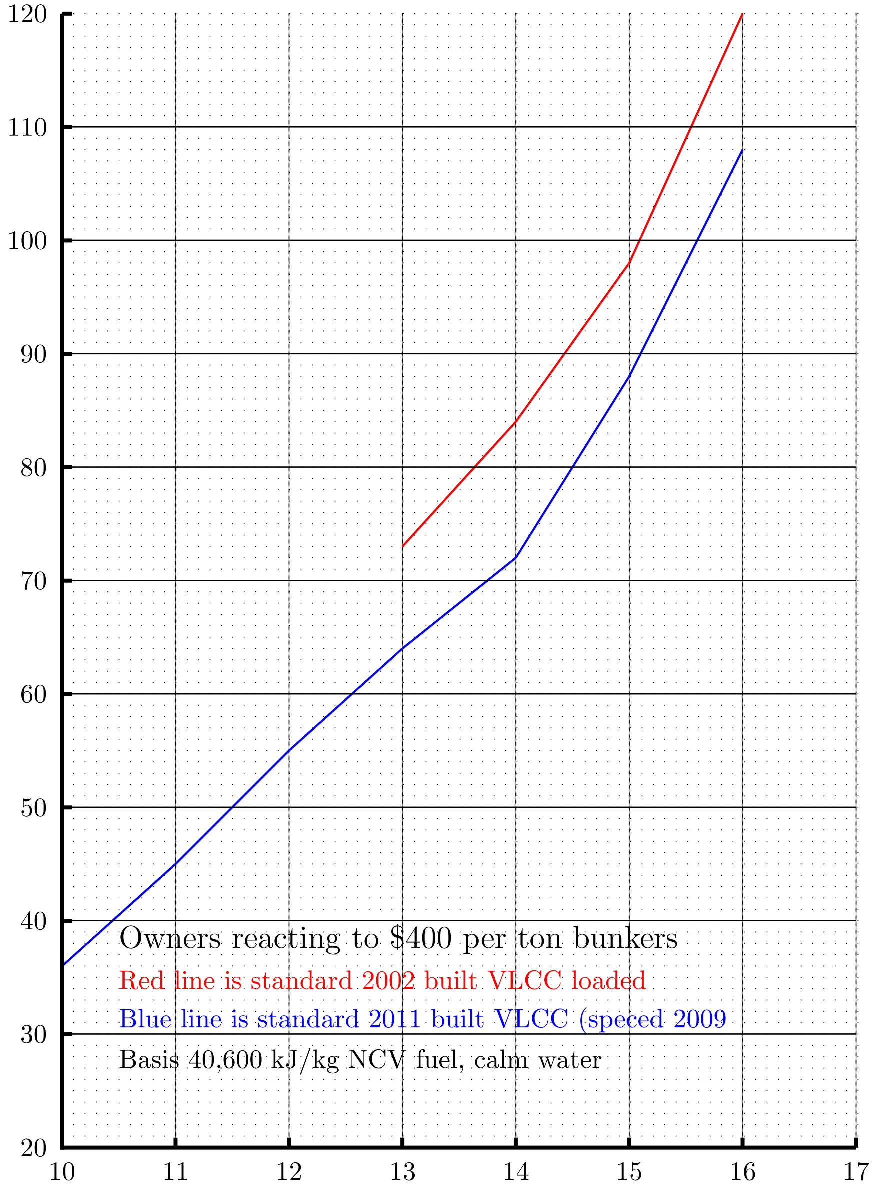

Figure 1: Loaded VLCC fuel consumption curves, 2002 vs 2011

24. (a) Owners guarantee that the speed and consumption of the vessel shall be as follows:-

Average speed in knots	Maximum average bunker consumption main propulsion - fuel oil/diesel oil	auxiliaries fuel oil/diesel oil
Laden	tonnes	tonnes
Ballast		

The foregoing bunker consumptions are for all purposes except cargo heating and tank cleaning and shall be pro-rated between the speeds shown.

The service speed of the vessel is knots laden and knots ballast and in the absence of Charterers' orders to the contrary the vessel shall proceed at the service speed. However, if more than one laden and one ballast speed are shown in the table above Charterers shall have the right to order the vessel to steam at any speed within the range set out in the table (the "ordered speed").

If the vessel is ordered to proceed at any speed other than the highest speed shown in the table, and the average speed actually attained by the vessel during the currency of such order excceds such ordered speed plus 0.5 knots (the "maximum recognized speed"), then for the purpose of calculating any increase or decrease of hire under this Clause 24 the maximum recognized speed shall be used in place of the average speed actually attained.

For the purposes of this charter the "guaranteed speed" at any time shall be the the then---current ordered speed or the service speed, as the case may be

The average speeds and bunker consumptions shall for the purposes of this Clause 24 be calculated by reference to the observed distance from the pilot station to pilot station on all sea passages during each period stipulated by Clause 24 (c), but excluding any time during which the vessel is (or but for Clause 22(b)(i) would be) off-hire and also excluding "Adverse Weather Periods", being (i) any periods during which reduction of speed is necessary for safety in congested waters or in poor visibility (ii) any days, noon to noon, when winds exceed force 8 on the Beaufort Scale for more than 12 hours.

(b) If during any year from the date on which the vessel enters service (anniversary to anniversary) the vessel falls below or exceeds the performance guaranteed in Clause 24(a) then if such shortfall or excess results

(i) from a reduction or an increase in the average speed of the vessel, compared to the speed guaranteed in Clause 24(a), then an amount equal to the value at the hire rate of the time so lost or gained, as the case may be, shall be deducted from or added to the hire paid;

(ii) from an increase or decrease in the total bunkers consumed, compared to the total bunkers which would have been consumed had the vessel performed as guaranteed in Clause 24(a), an amount equivalent to the value of the additional bunkers consumed or bunkers saved, as the case may be, based on the average price paid by Charterers for the vessel's bunkers in such period, shall be deducted from or added to the hire paid.

The addition to or deduction from hire so calculated for laden and ballast mileage respectively shall be adjusted to take into account the mileage steamed in each such condition during Adverse Weather Periods, by dividing such addition or deduction by the number of miles over which the performance has been calculated and multiplying by the same number of miles plus the miles steamed during the Adverse Weather Periods, in order to establish the total addition to or deduction from hire to be made for such period.

Reduction of hire under the foregoing sub-Clause (b) shall be withpout prejudice to any other remedy available to Charterers.

(c) Calculations under this Clause 24 shall be made for yearly periods terminating on each successive anniversary of the date on which the vessel enters service, and for the period between the last such anniversary and the darte of termination of this charter if less than a year. Claims in respect of reduction of hire arising under this Clause during the final year or part year of the charter period shall in the 1st instance be settled in accordance with Charterers' estimate made two months before the end of the charter period. Any necessary adjustment after this charter terminates shall be made by payement by Owners to Charterers or by Charterers to Owners as the case may require.

Payments in respect of increase of hire arising under this Clause shall be made promptly after receipt by Charterers of all the information necessary to calculate such increase.